

**Medium-voltage switchgear assembly**

This application is the national phase filing of  
5 International Application No. PCT/EP2004/014480 filed  
on December 20, 2004 published as WO 2005/062328 which  
designated at least one country other than the United  
States of America ("the PCT Application") and the PCT  
Application claims the priority of German Application  
10 No. 103 60 633.5 filed on December 19, 2003 ("the  
German Application") and the contents of the PCT  
Application and the German Application are relied upon  
and incorporated herein by reference in their entirety,  
and the benefit of priority under 35 U.S.C. 119 is  
15 hereby claimed.

The invention relates to a medium-voltage switchgear  
assembly having at least one switch disconnecter, as  
claimed in the precharacterizing clause of patent claim  
20 1.

Electrical switchgear assemblies, in particular  
medium-voltage switchgear assemblies, contain not only  
a circuit breaker, which is generally permanently  
25 installed, but also a disconnecter, which can assume  
three positions: connected position, disconnected  
position and grounding position; that is to say it is  
in the form of a three-position switch. Furthermore,  
the three-position switch can be provided with a  
30 load-interrupter and/or circuit-breaker function.

In the connected position, a connection is produced to  
the live busbar, and in the grounding position, a  
connection is produced to ground. In the disconnected  
35 position, the moving contact piece of the disconnecter  
is in a mid-position between the connected position and  
the grounding position.

Conventional three-position disconnectors are known in the form of in-line or knife switches. It is also known that an analogous functionality can also advantageously  
5 be provided by a "three-position vacuum switching chamber".

In general, disconnectors are used as an autonomous appliance in the same gas area as the load-interrupter  
10 switch or circuit breaker, or in a separate gas area, particularly in the case of double busbar arrangements. The electrical part of these appliances is always a component of the gas area, and is connected by means of a gas-tight bushing to the drive, which is located  
15 inside and outside the gas area, and in medium-voltage applications, is normally in the form of a mechanical or magnetic drive.

As an autonomous appliance, a disconnector - if  
20 arranged in the same area as the load-interrupter switch or circuit breaker - requires a correspondingly large enclosure, or requires its own gas area if arranged separately. The latter in turn means additional passages between the different gas areas.

25 In both cases, additional complexity is required for material, assembly and testing. The dimensions of the switchgear assembly are correspondingly large, and this is disadvantageous.

30 The invention is thus based on the object of developing a switchgear assembly of this generic type in such a way that it is more compact and more functional.

35 The stated object is achieved according to the invention for a switchgear assembly of this generic type by the characterizing features of patent claim 1.

Advantageous refinements relating to this are specified in the dependent claims.

5 The essence of the invention is in this case that the switch disconnecter is in the form of a three-position vacuum-chamber switch.

10 A further advantageous refinement specifies that the three-position vacuum switching chamber is designed such that it forms and replaces the bushing which leads from inside said gas area to outside the gas area, and forms a direct connection to the busbar.

15 The gas area may be in the form of a gas-insulated or solid-insulated busbar for three phases or else for one phase. Instead of a gas area, one half as well as the device can also be encapsulated in a further solid on both sides.

20 In another advantageous refinement, the three-position vacuum switching chamber is designed such that it is integrated in an annular seal which leads from inside said gas area to outside the gas area.

25 It is also advantageous for the three-position vacuum switching chamber to be integrated in a cast-resin bushing, that is to say can be provided with a cast-resin body.

30 In this case, the three-position vacuum switching chamber can be designed such that, with its ceramics, it itself forms the bushing.

35 Furthermore, in one advantageous refinement, the three-position switch is designed such that, in addition to the disconnection function, it can also carry out the functions of load switching and power switching.

In a final advantageous refinement, the described requirements for the disconnecter bushings can be used both for a single and a double busbar application.

- 5 For compact medium-voltage switchgear assemblies with a high level of function integration, it appears to be advantageous to integrate the disconnecter - in the form of a three-position vacuum switching chamber - directly in function-relevant parts, such as  
10 a cast-resin bushing, or to design the three-position vacuum switching chamber such that it (with its ceramics) itself forms the bushing. In the first-mentioned case, the encapsulation technology is well known in particular from vacuum switching  
15 chambers, and is prior art.

The object of the bushing is normally to connect the live current paths in different gas areas and to isolate them from the grounded encapsulation. At the  
20 same time, the bushing can provide mechanical stability between different enclosures, and can also maintain their separation.

The load-interrupter switch or circuit breaker is  
25 connected to one side of the three-position disconnecter. This side represents the feeder to the moving contact mount in the three-position vacuum switching chamber. As an electrical part of the disconnecter, the vacuum switching chamber can be  
30 completely encapsulated in cast-resin, with the cast-resin body being in the form of a bushing.

If the mechanical part of the disconnecter (drive) is located outside the gas area, it is normally connected to the vacuum switching chamber via a gas-tight bushing  
35 and a linkage.

The other side of the three-position vacuum switching chamber, the feeder to the fixed contact mount in the vacuum switching chamber, forms the direct connection

to the busbar. This connection can be formed under an insulating gas. A physically small gas area is then required in order to accommodate this connection and to continue the busbar to the gas area of the next switchgear panel or block (busbars joined together across a plurality of panel junctions). This gas area may be in the form of a traditional busbar area for three phases, or in the form of a gas-insulated busbar for one phase.

10

A block in turn comprises a plurality of switchgear panels with a common gas area. There are no moving parts whatsoever in this gas area. In addition, no switching operations are carried out in this gas area.

15

Furthermore, the connection of the three-position vacuum switching chamber to a rail with solid insulation may be in a plug-in form or may even, for example, be encapsulated in a solid once again, on one side or else on both sides. In this case, the bushing is designed to be protected against direct contact on the side associated with the busbar, that is to say it is provided with a conductive coating. The busbar may be connected via a plug-in contact, which is part of the bushing.

25

The bushing with the three-position vacuum switching chamber (DSK) is itself designed such that the connection to the busbar is made when the vacuum switching chamber is in the connected state. When the vacuum switching chamber is in the "disconnected position", that is to say also the mid-position between the connected position and the grounding position, different potentials can be isolated. This arrangement has a disconnection-path/isolation capability.

30

35

The invention will be described in more detail in the following text and is illustrated in the drawing, in which:

Figure 1: shows a switch disconnecter according to the invention.

5 Figure 2: shows a switch disconnecter according to the invention with direct function of a bushing.

Figure 3: shows a bushing switch disconnecter with a load-interrupter and circuit-breaker  
10 capability.

The grounding position requires a connection, integrated in the bushing, from a "ground point" to the metallic center part 2 of the vacuum switching chamber  
15 1, which is located between the isolating ceramics 3, 4 shown in Figure 1.

In the situation shown in Figure 1, in the same way as in the situation shown in Figure 2, in which the  
20 three-position vacuum switching chamber is itself used directly as the bushing, an edge board 5 is fitted to the metallic center part 2 of the three-position vacuum switching chamber, and allows the connection to the "ground point". The edge board 5 can also be equipped  
25 with a seal 6, which provides the seal to the gas area.

This can most expediently be achieved by the electrical ground connection forming a unit with the mechanical connection, so that the ground connection is ensured by  
30 the fitting of the bushing.

The described arrangement of the disconnecter bushing can be used both for single-busbar and for double-busbar applications.

35

The three-position vacuum switching chamber in the form of a bushing disconnecter can be designed as follows, based on even greater function integration.

**Figure 3** shows a corresponding bushing switch disconnecter with, in addition to the functions of a connected position, disconnected position and grounding position, can also carry out the function of load switching and power switching, that is to say it additionally has a load switching and power switching capability.

For this purpose, a vacuum switching chamber is used which, as illustrated in **Figure 3**, has a second area or at least one shielded area within a vacuum switching chamber, which can also be arranged separately on the vacuum switching chamber, in which this switching path is located.

This makes it possible to ensure that, in practice, no plasma can pass from this switching path into the area of the grounding path during the disconnection of load currents or short-circuit currents.

This reduces vaporization of the isolation paths, or prevents it entirely when using a separate area, thus providing safe isolation in the mid-position. This is achieved by disconnection of both paths by means of a bellows or by means of a labyrinth composed of interleaved shielding components.

A contact system can be located in the load-interrupter switching area, formed from blade contacts. The features of a circuit-breaker vacuum switching chamber are required for a short-circuit-current disconnection capability. Both RMF and AMF contact systems may be used for this purpose.

RMF is short for radial magnetic field, and AMF for axial magnetic field.

In contrast to three-position vacuum switching chambers without a disconnection capability, this switching chamber with a disconnection capability requires a drive which quickly separates the switching contact

pieces in a known manner, at least during disconnection of them, at least as far as the region of the disconnected position (mid-position).